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# A METHODICAL APPROACH TO DETERMINING THE LEVEL OF DEVELOPMENT OF DIGITAL TRADE IN GLOBAL MARKETS

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**ABSTRACT**

The global digital transformation market is showing increasing performance every year, and growth forecasts have a long-lasting effect. In the conditions of digitalization of the economy, the relevance of research in the field of digital economy in general and digital trade in particular is increasing. The study developed a methodical approach to determining the level of development of digital trade on global markets by determining the integral indicator and clustering countries. The research is based on categories of theoretical and empirical levels of knowledge. With the help of cluster analysis, the classification of countries was carried out by methods of classification of multidimensional indicators, based on the definition of the concept of distance between objects, followed by the selection of their groups of clusters. Using the cluster method, countries were represented, which made it possible to visualize the result of the mental process when building a methodical approach to determining the level of development of digital trade on global markets. The proposed methodological approach makes it possible to assess the level of development of digital trade, taking into account the specifics of the development of a certain country. The implementation of the proposed approach will make it possible to conduct a more complete analysis of digital trade and ensure the sustainable development of the economic system.

***Keywords:*** *digital economy, digitalization, methodology, integral indicator, indices, development, globalization, global economy*

## 1. INTRODUCTION

In recent years, due to the pandemic, the volume of the world economy has decreased. However, it is worth noting that this negative factor caused the rapid development of digitalization throughout the world. Lockdowns, as a result of closing and suspending the work of many industries. As a result, digital sectors of the economy are gaining special relevance.

According to experts' forecasts, the global digital transformation market will grow to $2.3 trillion in 2023. Digitalization affects all spheres of economy and social life. 90% of the leaders of the world's leading companies call digital transformation the main priority of their business. Big data processing systems give businesses enormous advantages, allowing them to save resources, make predictions and meet market expectations. Along with companies, states also compete in digitization. This necessity is dictated by modern socio-economic standards. Leadership in the digital economy is a guarantee not only of international prestige, but also of technical and humanitarian progress in the conditions of sustainable development.

For many years, the United States has been the unchanging leader of digitalization, followed by Europe, and now Asian countries are taking the first places in international rankings. According to the Digital Evolution Index, the "digital elite" include Singapore, Great Britain, New Zealand, the UAE,

Estonia, Hong Kong, Japan and Israel - these countries demonstrate the highest indicators of digital technology development. South Korea, Australia, Western Europe and Scandinavia are slowing down. China, Kenya, Russia, India, etc. can be considered promising countries. But in South Africa, Peru, Egypt, Greece, Pakistan, rates of digitization are still lower.

At the end of the last century, the leadership in the number was captured by the USA. The emphasis in the US was on digital commercial services: in the 1990s, the AMAZON trading platform and aggregator services for the sale of goods and services appeared. In European countries, digitization has also started in the service sector. In Great Britain, Europe's technological leader, the regulatory basis for the development of the digital economy is represented, in particular, by the law "On the Digital Economy" and the Digitalization Strategy adopted in 2017. Today, Britain prefers to invest in robotics and artificial intelligence, but socially significant areas that determine the standard of living of people are still prioritized: services, trade, banking, education, health care and transport.

Digital technologies are actively being implemented in the field of commercial operations. Their use becomes an important competitive advantage, as it fundamentally simplifies and accelerates access to consumers and markets, as well as opens up new opportunities for customization and introduction of new types of products. The development of digital commerce will require long-term commitment at the global level. The expediency of the involvement of the leadership at the national and regional levels, all levels of society, strong state institutions, capital investments, a modern and effective legal framework, is determined by the creation of digital transformation management structures with broad powers. Taking into account the scale of growth of digital trade, the formation of mechanisms and tools for monitoring the measures taken, measuring the achieved indicators and the results of transformations will be of the utmost importance. Thus, analyzing the above aspects, the author sees the need to reveal the level of development of digital trade of the countries of the world by clustering them according to digitalization indicators.

## 2.LITERATURE REVIEW

In the conditions of digitalization, in recent years, many works related to the digital economy have appeared, however, to achieve the goals of the study, the author analyzed the works related to the promotion of digital technologies in international trade Abeliansky A. L., and Hilbert M. (Abeliansky, Hilbert 2016), the work reveals the key issues of the impact of technologies on the development of trade, which ensures the development of the digital economy. In the work, a thorough study was carried out, which made it possible to make sure that the characteristics of developed countries and developing countries have their differences. For the current study, this is extremely important and was taken into account when clustering countries.

Bokovets V.V., Davydiuk L.P. (Bokovets, Davydiuk, 2021)reveal the issue of e-commerce from the point of view of promoting business development, in the opinion of the author, this work has thorough conclusions that are interesting for the current research.

To achieve the goal of the research, the author analyzed a number of works devoted to the dominance of the digital economy and digital transformation of global value chains, the results were reflected in the works of Deardorff A. V. (Deardorff, 2017), Freund C., and Weinhold D. (Freund, Weinhold, 2002), Fu X. (Fu, 2020).

Also, for the current research, works devoted to the digital economy, its development and state in the conditions of globalization processes are extremely important. In the work Ahmedov I. (Ahmedov, 2020) revealed the role of digitization processes in the economy and its impact on trade. Emphasis is placed on the digital space as the main element of world trade. The author emphasizes that the paradigm shift of digital trade and cross-border virtual space will lead to the rapid development of the digital economy around the world. Also, as part of the study, the work of Huaping G., Binhua G. was considered (Huaping, Binhua, 2022) which is devoted to the digital economy and the general structure of demand for personnel.

The work of Semenog A.Yu. (Semenog, 2020), which investigates the current state of development and formation of the digital economy, which is extremely relevant for the current study, allowed us

to draw certain conclusions that were reflected in the proposed methodical approach to the development of the digital economy in the context of globalization.

Also, the work of Pyshchulina O. is an important achievement (Pyshchulina, 2020), which reveals the main trends, warns about risks and characterizes the social determinants of the digital economy. The study is dedicated to revealing the current stage of development of the digital economy through digitalization. The work reveals the social determinants and grounds for the development of the digital economy, the introduction and use of digital technologies. In addition, the potential risks and threats of digitalization in the world are analyzed.

The work of Pahwa A. (Pahwa, 2022), which refers to the digital economy for this study, served as the basis for creating a theoretical basis by which the digital ecosystem was defined.

The transformation of the market transition to the digital economy is revealed in the work of Lytovchenko I.L. (Lytovchenko, 2020) and is the basis for the study of works related to insider profits and foreign investments, which are levers for ensuring the development of the digital economy. That is why the work analyzed the works of some scientists such as: Aboody D., and Lev B. (Aboody, Lev, 2000), Aizenman J., and Noy I. (Aizenman, Noy, 2006), Barro R.J. (Barro, 2001), Chuang Y.C., and Hsu P.F. (Chuang, Hsu, 2004), which is a significant contribution to the current study.

Digitalization assessment and political dimensions are revealed in Aliev T. M., Ismagilova O. D., and Popova V. N. (Aliev, Ismagilova, Popova, 2020). In the work of Dziuba Yu. V., Doronina O.A. (Dziuba, Doronina, 2020), which is dedicated to highlighting the features of the transformation of the global labor market under the influence of the processes of digitalization of the economy. The work concludes that not all subjects of the labor market want to use information technologies in their activities, but the influence of the digitalization process on the global labor market is constantly increasing. Thanks to the use of digital technologies, new types of relations between employees and employers are emerging. Also, thanks to digitalization, it is possible to increase the percentage of employed people in different countries.

In the opinion of the author, it was also appropriate to study works that directly affect only digitalization, its impact on globalization and the persistence of competitive advantages. Therefore, the work disclosed in the study: Gupta M. S. (Gupta, 2020), Rwanda F.-E.-S. (Rwanda, 2020), Pizhuk O. I. (Pizhuk ,2019) and Knudsen E. S., Lien L. B., Timmermans B., Belik I., and Pandey, S. (Knudsen et al., 2021).

Also, it is worth paying attention to the work of Henfridsson O. and Bygstad B. (Henfridsson, Bygstad, 2013), which is devoted to the generative mechanisms of the evolution of digital infrastructure and Ittelson P. (Ittelson, 2022), which define the role of standards in digital transformation and digital trade.

Thus, the topic of research is really quite relevant, a lot of works today are dedicated to its disclosure and in the future their number will increase. However, in the opinion of the author, despite the number of scientific achievements, the issues of the development of the digital economy, taking into account the characteristics of countries, remain unresolved. A significant number of indices and indicators are sufficiently unstudied and prompt current research.

## 3.AIM OF THE RESEARCH

The purpose of the study is to develop a methodical approach to determining the level of development of digital trade in global markets by determining the integral indicator and clustering countries.

## 4.METHODS

A characteristic feature of the study is the study and consideration of socio-economic processes, which were carried out through the analysis of scientific activity and its results, as well as through the identification of current interests and current problems and needs of society in the conditions of the digital economy.

The research is based on categories of theoretical (hypothesis, concept, theory, problem) and empirical (facts, empirical generalizations, empirical dependencies) levels of knowledge, the characteristic features of which are: objectivity; rationality; high level of generalization; universality and use of

special ways and methods of cognitive activity. Scientific and special research methods were used to achieve the goal and solve research problems. The work uses theoretical research methods that combine abstraction and generalization with the aim of systematizing the material to achieve the research goal. An analysis of the literature was carried out in order to better understand the research topic and identify promising directions. With the help of synthesis, the work combined disparate elements into a single whole in order to obtain a general idea of digital trade in global markets. Modeling for a detailed study of digital commerce. Classification for the distribution of information by digitization and the level of development of digital government based on common features. An analogy for finding certain certain similarities between countries, in order to build clusters. Abstracting to identify the characteristics of the development of digital trade in global markets. Each of the methods and tools has its advantages and disadvantages related to the various factors used to ensure the equilibrium state of the economy, as well as the combined use of these methods and tools. at the right moment contributes to the achievement of the chosen goal.

The usual form of presentation of initial data in tasks of cluster analysis is a matrix: each row of which represents the result of measurements of k analyzed features on one of the surveyed objects.

$$X = \begin{pmatrix} x_{11} & x_{12} & x_{13} & x_{14} \\ x_{21} & x_{22} & x_{23} & x_{24} \\ \cdots & \cdots & \cdots & \cdots \\ x_{i1} & x_{i2} & x_{i3} & x_{i4} \\ \cdots & \cdots & \cdots & \cdots \\ x_{a1} & x_{a2} & x_{a3} & x_{a4} \end{pmatrix}$$

The choice of distance (p) is the main moment of the study, which depends on the final options for the division. The most common are the “nearest neighbor” or “distant neighbor” principles. In the first case, the distance between clusters is taken as the distance between the closest elements of these clusters, while in the second - between the most distant from each other.

Euclidean and Hamming distances are often used in cluster analysis tasks.

The Euclidean distance is determined by the formula:

$$P_E(x_i, x_j) = \sqrt{(x_i^{1.2-k} - x_j^{1.2-k})^2}$$

the proximity of two objects is compared by a large number of features.

Hemingway distance:

is used as a measure of the difference of objects given by attributive features.

$$P_E(x_i, x_j) = \sum_{i,j}^{1.2-k} \left| x_i^{1.2-k} - x_j^{1.2-k} \right|$$

With the help of cluster analysis, the classification of countries was carried out by methods of classification of multidimensional indicators (digitalization and digital government), based on the definition of the concept of distance between objects, followed by the selection of their groups of observations (clusters). Using the cluster method, countries were represented, which made it possible to visualize the result of the mental process when building a methodical approach to determining the level of development of digital trade on global markets. A feature of this study is the construction of a methodological approach to determining the level of development of digital trade in global markets using a set of methods, tools of digital policy aimed at stimulating economic activity and implementing social initiatives, as well as ensuring competitiveness in global markets.

The integral index is built as a linear combination of selected indicators with different weights:

$$y = w1x1 + w\,2\,x\,2 + \ldots + wj\,x\,j + \ldots + wn\,x\,n,$$

where y - the integral index;

xj - structural elements of the integral index;

wj - weights with which structural elements are included in the integral index.

To determine the weight of each indicator, an approach was used based on the calculation of pairwise correlation coefficients, which are an estimate of the closeness of the relationship between changes in indicators over time.

If rij is the pairwise correlation coefficient between the i-th and j-th indicators (i, j = 1, 2, ..., n), then the weights are determined by the following formula:

$$w_j = \sum_{j=1}^{n} r_{ij} / \sum_{j=1}^{n} * \sum_{i=1}^{n} r_{ij}$$

The sum of the coefficients of pair correlation of each indicator with the rest is correlated with the total sum of coefficients according to the matrix of coefficients of pair correlation. Given that the latter reflects the relationship between all indicators, the obtained values of wj show the specific weight of each indicator in the total value of the integral index. As a result, by accordingly weighing the compared values of the indicators for each year and summing them up, we get the value of the integral index.

The results of the calculations are presented in Table 1.

Table 1. Integral indicators of the level of development of digital trade in global markets: a description of the constituent elements

| Indicator | Indicator weight |
|---|---|
| Leading index | |
| DEI (Digital Evolution Index) | 0,124 |
| GII (Global Innovation Index) | 0,161 |
| DESI (Digital Economy and Society Index) | 0,153 |
| Matching index | |
| NRI (Networked Readiness Index) | 0,243 |
| e-Intensity (Boston Consulting Group) | 0,245 |
| WDCI (IMD World Digital Competitiveness Index ) | 0,240 |
| Lagging index | |
| DAI Digital Adoption Index) | 0,144 |
| IDI (ICT Development Index) | 0,130 |

Source: Author calculated

As can be seen in Table 1, three target integral indices were formed. To understand the close relationship with the reference indicator, the intercorrelation functions of the annual growth rates of the calculated integral indices were calculated.

The results fully confirmed the correctness of the obtained structure of integral indicators.

In the case of the leading integrated index, the maximum value of the coefficient of mutual correlation in the influence of the lagging index on the development of digital trade is r2 = 0.948.

There is no lag between changes in the digital trade index and the coincident integral index with a maximum correlation coefficient of r0 = 0.954.

The connection between digital trading and the lagged integral index is also significant. The maximum cross-correlation coefficient indicates the presence of a lag in the change of the lagged integral index with respect to the dynamics of digital trade with r8 = 0.971.

It is worth noting that confirming the correctness of the chosen structure of integral indicators, the obtained results hide another important conclusion. The identified asymmetry of leading and lagging has high practical significance, in particular, when forecasting economic dynamics in Ukraine.

A regression equation was constructed (taking into account the lags) characterizing the dependence of industrial production on integral indices. So, for the leading index, the regression equation has the form

$$Y = 112{,}605 + 0{,}056x,$$
$$(95{,}447)\quad (32{,}962)$$

where Y is the index of industrial production in %,

x is the leading index in %.

The values of the t-test for the regression coefficients are indicated in parentheses under the equation.

The coefficient of determination is 0.899, the Durbin-Watson criterion is 0.0565.

On the basis of this equation, the forecast values of the index of industrial production for July and August 2009 were obtained - 163.9 and 166.5%, respectively. The forecast error did not exceed 2.9%.

The information base of the research is the scientific development of theoretical economists and practicing economists.

## 5. MODELING RESULTS

Over the past two decades, there has been a rapid growth of information and communication technologies and an increase in their role in economic development. An additional stimulus for the development of digitalization was provided by the pandemic of the coronavirus infection (COVID-19). Digitalization has changed many aspects of human society. It has significantly affected business processes in international trade, reducing costs, increasing the volume and speed of cross-border transactions. E-commerce, the scale of which is growing year by year, is becoming the most important engine of trade. Among the main trends caused by digitization and affecting international trade, we can include: the growth of e-commerce volumes in the world and the turnover of global marketplaces; increasing the scale of international trade in information and communication goods and services, as well as services delivered in digital form; the growth of the world export of services by the first method of supply, i.e. in the form of cross-border supplies. The dynamism of the digitalization process leads to the emergence of problems of its assessment - determining the level of digitalization of the economy and its individual segments, primarily international trade and related digital trade policy measures. Leading international organizations (including the OECD, WTO, IMF, UNCTAD) are engaged in the development of approaches to solving these problems.

In order to build a methodical approach to determine the level of development of digital trade on global markets, the author considers it necessary to conduct an analysis of the indicator of the level of digitalization over 10 years in 86 countries of the world. The work uses publicly available data in order to conduct a detailed analysis of the level of digitization in the world. The author of the study collected data and evaluated the dynamics of the level of digitization in Table 2.

Table 2. Analysis of the level of digitization of the countries of the world from 2012-2022

| Country | The level of digitization | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 | 2022 |
| Singapore | 50,21 | 56,21 | 60,87 | 65,33 | 78,69 | 79,01 | 80,63 | 84,31 | 98,82 | 71,86 | 65,47 |
| USA | 49,71 | 51,79 | 50,37 | 65,27 | 69,20 | 70,14 | 73,78 | 78,09 | 89,82 | 73,81 | 65,78 |
| Finland | 46,59 | 51,49 | 55,32 | 59,87 | 63,27 | 70,89 | 80,92 | 83,39 | 87,30 | 75,84 | 68,26 |
| Denmark | 47,02 | 49,03 | 53,76 | 59,98 | 63,28 | 66,13 | 73,62 | 77,69 | 87,17 | 83,80 | 73,47 |
| Norway | 45,36 | 47,04 | 52,06 | 56,47 | 62,38 | 68,89 | 74,30 | 80,49 | 85,34 | 69,24 | 63,89 |
| Switzerland | 51,12 | 53,32 | 56,62 | 61,08 | 67,24 | 70,25 | 75,81 | 82,37 | 86,89 | 70,85 | 65,70 |
| Netherlands | 48,30 | 49,86 | 54,10 | 58,39 | 64,11 | 69,44 | 72,74 | 81,14 | 85,48 | 70,61 | 68,43 |
| Sweden | 54,21 | 55,23 | 57,77 | 60,03 | 63,47 | 68,22 | 70,23 | 79,44 | 85,07 | 70,10 | 68,95 |
| Iceland | 44,01 | 47,56 | 50,27 | 54,13 | 61,02 | 67,36 | 74,73 | 82,08 | 84,29 | 73,69 | 70,15 |
| Ireland | 40,35 | 45,81 | 49,35 | 53,29 | 58,31 | 66,74 | 72,73 | 79,91 | 82,32 | 65,27 | 61,49 |
| South Korea | 48,77 | 50,63 | 54,13 | 59,48 | 65,89 | 72,03 | 77,39 | 78,88 | 83,09 | 76,63 | 66,60 |
| Australia | 47,20 | 48,14 | 54,13 | 59,64 | 63,44 | 69,12 | 75,16 | 79,35 | 80,09 | 68,42 | 58,06 |
| Canada | 48,98 | 51,17 | 54,89 | 59,69 | 62,55 | 63,89 | 69,78 | 78,22 | 80,24 | 66,52 | 60,38 |
| New Zealand | 44,03 | 46,26 | 47,08 | 53,70 | 59,99 | 64,78 | 77,26 | 80,06 | 80,46 | 64,81 | 59,66 |
| Germany | 44,20 | 47,18 | 50,09 | 56,78 | 60,17 | 66,89 | 71,24 | 76,33 | 79,27 | 70,80 | 71,23 |
| Austria | 40,18 | 44,13 | 51,20 | 54,39 | 59,98 | 66,55 | 70,81 | 74,17 | 75,42 | 66,61 | 62,14 |
| Japan | 41,23 | 45,71 | 49,67 | 53,34 | 59,61 | 64,33 | 70,25 | 73,14 | 77,76 | 70,24 | 67,85 |
| Estonia | 35,06 | 39,36 | 41,20 | 47,34 | 50,03 | 56,12 | 65,91 | 70,46 | 76,66 | 66,44 | 65,54 |
| Israel | 35,87 | 39,69 | 42,03 | 44,77 | 49,93 | 58,88 | 64,38 | 71,30 | 75,02 | 74,40 | 76,10 |
| UAE | 33,23 | 43,29 | 46,36 | 50,00 | 54,10 | 60,09 | 67,59 | 69,39 | 74,44 | 57,69 | 51,30 |
| Belgium | 39,54 | 43,49 | 47,34 | 49,37 | 52,48 | 61,26 | 67,74 | 71,19 | 74,51 | 63,83 | 62,35 |
| France | 39,60 | 44,07 | 46,33 | 48,20 | 51,07 | 57,71 | 62,30 | 70,25 | 72,99 | 71,20 | 71,05 |
| Spain | 35,36 | 37,29 | 41,30 | 44,99 | 50,86 | 56,88 | 60,82 | 64,29 | 66,95 | 67,63 | 65,33 |
| Slovenia | 30,24 | 33,17 | 38,12 | 44,11 | 49,88 | 54,17 | 62,53 | 66,01 | 67,35 | 60,47 | 58,67 |
| Czech | 29,38 | 31,87 | 36,64 | 41,50 | 49,68 | 54,33 | 63,42 | 64,12 | 68,68 | 62,24 | 61,23 |
| Malaysia | 34,66 | 39,43 | 43,01 | 48,33 | 52,01 | 55,14 | 60,08 | 64,31 | 69,03 | 61,46 | 55,80 |
| Lithuania | 30,28 | 37,18 | 40,31 | 43,75 | 47,44 | 50,12 | 52,33 | 65,58 | 68,02 | 68,62 | 66,48 |
| Qatar | 31,46 | 36,55 | 38,88 | 43,60 | 49,16 | 53,47 | 60,00 | 60,89 | 66,58 | 60,63 | 50,88 |
| Portugal | 30,67 | 33,41 | 37,88 | 40,12 | 43,88 | 50,23 | 56,31 | 62,23 | 65,75 | 61,82 | 62,60 |
| Slovakia | 25,13 | 28,27 | 30,08 | 33,15 | 39,37 | 44,02 | 51,04 | 60,94 | 63,01 | 62,09 | 59,32 |
| Latvia | 25,41 | 29,68 | 31,20 | 30,16 | 36,77 | 42,54 | 55,03 | 61,22 | 65,06 | 58,37 | 58,54 |
| Poland | 22,58 | 26,73 | 29,17 | 35,17 | 39,99 | 46,68 | 54,22 | 60,78 | 63,58 | 63,62 | 61,50 |
| Saudi Arabia | 28,74 | 31,87 | 36,26 | 39,16 | 44,10 | 49,99 | 53,62 | 59,18 | 62,42 | 55,67 | 48,38 |
| China | 27,31 | 32,20 | 34,45 | 37,77 | 41,23 | 47,69 | 54,17 | 55,33 | 61,89 | 65,22 | 52,61 |
| Bahrain | 28,06 | 35,18 | 38,80 | 44,03 | 46,31 | 50,09 | 55,27 | 57,44 | 63,00 | 59,06 | 44,88 |
| Italy | 24,36 | 27,12 | 33,06 | 37,80 | 36,12 | 45,18 | 53,41 | 59,21 | 61,27 | 63,81 | 63,30 |
| Hungary | 19,34 | 21,92 | 22,00 | 26,33 | 34,17 | 42,99 | 50,42 | 53,09 | 57,75 | 61,07 | 59,99 |
| Croatia | 24,51 | 26,69 | 31,02 | 35,60 | 38,64 | 46,19 | 53,78 | 54,19 | 56,60 | 59,21 | 58,80 |
| Greece | 23,18 | 24,08 | 29,98 | 34,50 | 40,02 | 46,98 | 53,52 | 52,28 | 56,54 | 59,27 | 55,61 |
| Bulgaria | 26,45 | 29,87 | 32,08 | 36,77 | 35,03 | 43,78 | 49,42 | 50,84 | 57,14 | 56,83 | 59,07 |
| Romania | 25,09 | 29,33 | 31,29 | 34,78 | 38,80 | 41,09 | 46,70 | 47,60 | 54,06 | 60,08 | 58,47 |
| Uruguay | 26,31 | 28,05 | 33,01 | 36,15 | 38,88 | 42,37 | 47,15 | 52,00 | 54,29 | 53,28 | 54,72 |
| Thailand | 25,34 | 28,42 | 32,09 | 36,66 | 38,94 | 43,02 | 47,06 | 54,98 | 53,04 | 56,84 | 49,04 |
| Turkey | 26,07 | 31,95 | 33,04 | 36,67 | 39,88 | 45,17 | 49,33 | 50,36 | 52,43 | 54,60 | 48,14 |
| Georgia | 19,45 | 23,77 | 25,69 | 29,13 | 34,58 | 41,39 | 50,34 | 51,41 | 53,46 | 50,04 | 41,27 |

| Country | The level of digitization | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 | 2022 |
| Costa Rica | 20,01 | 24,89 | 27,88 | 30,04 | 36,49 | 42,00 | 49,84 | 50,27 | 52,08 | 52,60 | 44,47 |
| South Africa | 24,69 | 30,06 | 33,47 | 36,14 | 39,18 | 44,30 | 48,66 | 49,63 | 50,79 | 49,31 | 41,31 |
| Serbia | 20,39 | 25,17 | 28,89 | 34,67 | 39,98 | 43,10 | 47,56 | 51,48 | 52,27 | 56,64 | 49,76 |
| Kazakhstan | 21,33 | 26,96 | 30,07 | 31,28 | 36,66 | 42,07 | 49,88 | 50,20 | 50,71 | 54,80 | 44,05 |
| Azerbaijan | 22,58 | 27,77 | 30,00 | 34,74 | 38,88 | 43,11 | 47,54 | 50,17 | 51,85 | 49,21 | 39,17 |
| Jordan | 23,01 | 25,69 | 28,66 | 31,09 | 34,78 | 39,57 | 46,38 | 48,69 | 49,07 | 37,60 | 33,95 |
| Argentina | 24,37 | 26,88 | 29,13 | 34,41 | 38,97 | 42,34 | 45,28 | 47,75 | 48,26 | 55,63 | 51,06 |
| Indonesia | 15,36 | 19,85 | 21,34 | 26,28 | 31,09 | 38,99 | 44,39 | 45,21 | 47,72 | 48,41 | 40,32 |
| Brazil | 24,36 | 29,86 | 32,08 | 34,78 | 36,84 | 41,31 | 43,21 | 46,62 | 47,19 | 53,62 | 45,95 |
| Mexico | 24,34 | 27,23 | 30,00 | 34,27 | 33,97 | 37,02 | 42,95 | 44,20 | 45,86 | 49,83 | 43,02 |
| Vietnam | 18,56 | 20,29 | 24,66 | 29,16 | 34,45 | 38,20 | 41,19 | 45,38 | 46,79 | 48,23 | 40,72 |
| Ukraine | 19,06 | 21,09 | 24,66 | 27,61 | 32,03 | 34,22 | 39,75 | 44,19 | 46,03 | 56,61 | 48,93 |
| India | 20,14 | 23,17 | 25,31 | 28,99 | 32,08 | 33,41 | 39,05 | 45,23 | 46,57 | 52,43 | 44,36 |
| Philippines | 17,55 | 19,38 | 20,07 | 23,36 | 25,08 | 31,58 | 39,67 | 43,39 | 44,29 | 56,21 | 45,20 |
| Rwanda | 18,61 | 21,22 | 25,39 | 24,01 | 28,97 | 33,01 | 38,33 | 40,24 | 42,75 | 40,28 | 39,12 |
| Kenya | 14,41 | 16,98 | 19,36 | 22,45 | 24,87 | 34,12 | 37,46 | 39,48 | 44,08 | 46,42 | 38,36 |
| Iran | 14,11 | 17,08 | 20,18 | 22,09 | 25,32 | 30,00 | 36,54 | 40,25 | 43,13 | 45,60 | 34,78 |
| Colombia | 18,32 | 22,97 | 25,07 | 29,88 | 34,05 | 32,08 | 37,14 | 45,07 | 43,80 | 50,20 | 44,61 |
| Namibia | 17,15 | 20,98 | 24,10 | 27,45 | 30,14 | 32,07 | 35,17 | 37,55 | 42,69 | 35,80 | 27,40 |
| Ecuador | 17,20 | 19,62 | 21,00 | 28,01 | 26,34 | 29,16 | 33,51 | 36,43 | 40,90 | 47,41 | 36,43 |
| Ghana | 18,31 | 21,28 | 23,05 | 27,70 | 29,64 | 32,50 | 37,53 | 40,28 | 41,69 | 42,60 | 33,30 |
| Sri Lanka | 17,63 | 22,03 | 25,07 | 29,64 | 30,08 | 33,10 | 34,88 | 39,46 | 42,83 | 41,28 | 33,02 |
| Tunisia | 19,03 | 22,47 | 24,30 | 26,64 | 25,00 | 28,36 | 32,85 | 33,41 | 40,94 | 46,23 | 38,48 |
| Peru | 18,58 | 23,64 | 22,08 | 24,59 | 27,13 | 30,05 | 34,36 | 35,48 | 40,15 | 49,24 | 40,18 |
| Morocco | 18,30 | 23,01 | 22,41 | 26,39 | 28,02 | 31,12 | 36,66 | 38,88 | 40,58 | 44,40 | 40,51 |
| Lebanon | 17,58 | 22,34 | 24,00 | 26,13 | 29,41 | 30,12 | 32,10 | 38,47 | 40,05 | 40,78 | 41,23 |
| Bosnia and Herzegovina | 16,55 | 23,17 | 20,17 | 25,13 | 28,89 | 30,12 | 31,15 | 34,33 | 39,65 | 47,60 | 37,85 |
| Egypt | 11,69 | 17,28 | 25,17 | 20,17 | 26,33 | 30,78 | 33,60 | 36,00 | 39,41 | 35,87 | 34,75 |
| Pakistan | 16,36 | 20,14 | 25,10 | 23,48 | 28,20 | 30,88 | 32,09 | 30,47 | 34,03 | 37,16 | 30,76 |
| Uganda | 17,09 | 19,64 | 21,03 | 24,44 | 25,06 | 24,10 | 29,08 | 31,45 | 33,70 | 30,14 | 29,38 |
| Tanzania | 16,17 | 18,33 | 20,40 | 25,00 | 23,99 | 25,87 | 28,18 | 30,37 | 33,34 | 31,62 | 25,31 |
| Algeria | 14,13 | 17,52 | 20,16 | 24,39 | 26,78 | 24,05 | 26,39 | 28,11 | 34,31 | 43,07 | 32,22 |
| Ivory Coast | 15,33 | 18,47 | 20,33 | 24,16 | 22,00 | 24,78 | 25,14 | 30,63 | 32,16 | 39,40 | 29,46 |
| Bangladesh | 17,41 | 20,11 | 19,44 | 23,04 | 26,70 | 24,21 | 26,34 | 29,64 | 32,67 | 34,20 | 38,49 |
| Bolivia | 16,64 | 19,20 | 18,03 | 21,33 | 25,07 | 26,78 | 28,61 | 29,06 | 30,82 | 37,01 | 31,87 |
| Cambodia | 15,22 | 19,13 | 20,36 | 24,55 | 23,08 | 25,60 | 27,13 | 30,14 | 32,31 | 27,61 | 28,45 |
| Laos | 16,27 | 18,21 | 19,99 | 24,13 | 22,82 | 24,69 | 26,55 | 28,29 | 32,14 | 34,82 | 22,90 |
| Nigeria | 10,08 | 13,77 | 15,03 | 17,54 | 16,99 | 20,14 | 22,64 | 25,66 | 27,75 | 36,61 | 34,37 |
| Cameroon | 11,34 | 14,02 | 16,13 | 18,21 | 17,05 | 20,66 | 23,15 | 24,19 | 28,01 | 27,88 | 20,92 |
| Ethiopia | 9,14 | 11,80 | 14,66 | 16,38 | 15,02 | 16,47 | 17,52 | 20,88 | 21,11 | 19,85 | 20,04 |

Source: systematized by the author based on International Trade Commission of the United States, BCG, The World Bank

As can be seen from Table 2., the trend in the world can be traced from a developed digital environment to countries that are just implementing digitalization. The coronavirus disease 2019 (COVID-19) pandemic has accelerated the digital revolution and accelerated the process of global digital commerce. In the immediate aftermath of the COVID-19 outbreak, governments around the

world issued lockdown, quarantine, restriction and shutdown orders. To maintain the rhythm of life and learning, society needs to look for alternative methods, including telemedicine, the virtual classroom, online shopping, social interactions and remote work that includes all aspects of living in isolation. All this requires access to the Internet and digital technologies, so digital commerce, especially digital services, has grown rapidly. Compared to 2008 and 2020 data from the International Trade in Digital Services (DDS) published by UNCTAD, exports of international trade in digital services increased from approximately US$1.88 trillion to approximately US$3.17 trillion, and its share in global services exports increased from 46.30 to 63.55%, indicating that digital trade has become the new major driver of global services trade growth. Meanwhile, a UNCTAD report (2021) shows that the COVID-19 pandemic has also revealed a highly uneven global digital transformation between countries, particularly with countries such as the US, UK and Ireland. ranks first in the export of supply-side digital trade in services, while India, Japan and China were among the leaders in the growth rate of supply-side digital trade, accounting for 11.37, 9.89 and 8.61% respectively. It may be known that low-income countries are more likely to face digital barriers due to lack of access to the Internet, as well as insufficient knowledge and independent use of digital devices. However, these countries had a high level of development potential.

It is the developed digital environment and physical infrastructure that are necessary for the arrangement of the digital ecosystem. The availability of broadband Internet, the quality of roads for the delivery of goods from online stores and other factors must be taken into account when ensuring a decent level of digitization. It is worth following the trend among the population, whether it has the ability to participate in the digital economy. The next element is the country's laws and government actions that facilitate or hinder the development of digital technologies. Availability of investments in digitization by the state. It is necessary to monitor whether the adopted measures of state regulation contribute to the use and storage of data. The last element is an analysis of the development of the main components of the innovation ecosystem: a) access to talent and capital; b) processes and c) access to the consumer.

To achieve the goal, the author considers it necessary to evaluate the economy of the countries of the world with the level of development of digital government. (Table 3).

Table 3. Analysis of the level of development of digital government from 2012-2022

| Country | The level of development of digital government | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 | 2022 |
| Singapore | 0,85 | 0,88 | 0,91 | 0,93 | 0,84 | 0,87 | 0,88 | 0,91 | 0,92 | 0,90 | 0,92 |
| USA | 0,87 | 0,87 | 0,87 | 0,87 | 0,84 | 0,86 | 0,88 | 0,90 | 0,93 | 0,91 | 0,92 |
| Finland | 0,85 | 0,85 | 0,84 | 0,84 | 0,75 | 0,83 | 0,88 | 0,90 | 0,95 | 0,94 | 0,93 |
| Denmark | 0,89 | 0,83 | 0.81 | 0.80 | 0.81 | 0.87 | 0.91 | 0.94 | 0.97 | 0.96 | 0.97 |
| Norway | 0,86 | 0,85 | 0,84 | 0,85 | 0,84 | 0,84 | 0,86 | 0,89 | 0,91 | 0,90 | 0,91 |
| Switzerland | 0,81 | 0,80 | 0,73 | 0,74 | 0,80 | 0,78 | 0,85 | 0,87 | 0,89 | 0,87 | 0,89 |
| Netherlands | 0,91 | 0,90 | 0,89 | 0,87 | 0,87 | 0,87 | 0,88 | 0,91 | 0,92 | 0,91 | 0,93 |
| Sweden | 0,86 | 0,84 | 0,82 | 0,81 | 0,83 | 0,84 | 0,89 | 0,92 | 0,94 | 0,90 | 0,92 |
| Iceland | 0,78 | 0,78 | 0,80 | 0,79 | 0,80 | 0,81 | 0,83 | 0,91 | 0,91 | 0,89 | 0,90 |
| Ireland | 0,71 | 0,75 | 0,78 | 0,80 | 0,80 | 0,81 | 0,83 | 0,84 | 0,84 | 0,83 | 0,84 |
| South Korea | 0,93 | 0,94 | 0,95 | 0,94 | 0,94 | 0,92 | 0,90 | 0,95 | 0,96 | 0,95 | 0,93 |
| Australia | 0,84 | 0,85 | 0,91 | 0,91 | 0,90 | 0,90 | 0,91 | 0,94 | 0,94 | 0,94 | 0,95 |
| Canada | 0,84 | 0,84 | 0,84 | 0,84 | 0,85 | 0,86 | 0,83 | 0,82 | 0,84 | 0,84 | 0,85 |
| New Zealand | 0,84 | 0,84 | 0,86 | 0,85 | 0,84 | 0,87 | 0,88 | 0,92 | 0,93 | 0,93 | 0,93 |
| Germany | 0,81 | 0,80 | 0,79 | 0,79 | 0,81 | 0,83 | 0,88 | 0,87 | 0,85 | 0,84 | 0,85 |
| Austria | 0,78 | 0,79 | 0,79 | 0,81 | 0,82 | 0,82 | 0,83 | 0,87 | 0,89 | 0,87 | 0,89 |
| Japan | 0,80 | 0,87 | 0,89 | 0,89 | 0,89 | 0,86 | 0,88 | 0,89 | 0,90 | 0,87 | 0,89 |
| Estonia | 0,80 | 0,79 | 0,82 | 0,82 | 0,84 | 0,88 | 0,85 | 0,93 | 0,95 | 0,90 | 0,93 |
| Israel | 0,81 | 0,81 | 0,82 | 0,82 | 0,81 | 0,80 | 0,80 | 0,83 | 0,84 | 0,85 | 0,84 |

| Country | The level of development of digital government | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 | 2022 |
| UAE | 0,73 | 0,72 | 0,71 | 0,70 | 0,76 | 0,80 | 0,83 | 0,84 | 0,86 | 0,86 | 0,86 |
| Belgium | 0,77 | 0,76 | 0,76 | 0,77 | 0,78 | 0,80 | 0,81 | 0,80 | 0,80 | 0,78 | 0,81 |
| France | 0,86 | 0,87 | 0,89 | 0,88 | 0,87 | 0,86 | 0,88 | 0,88 | 0,87 | 0,86 | 0,87 |
| Spain | 0,78 | 0,81 | 0,84 | 0,83 | 0,84 | 0,84 | 0,84 | 0,86 | 0,88 | 0,87 | 0,88 |
| Slovenia | 0,75 | 0,70 | 0,65 | 0,68 | 0,67 | 0,75 | 0,77 | 0,84 | 0,85 | 0,80 | 0,84 |
| Czech | 0,65 | 0,61 | 0,61 | 0,61 | 0,62 | 0,65 | 0,71 | 0,80 | 0,81 | 0,78 | 0,82 |
| Malaysia | 0,67 | 0,63 | 0,61 | 0,61 | 0,67 | 0,69 | 0,72 | 0,77 | 0,79 | 0,74 | 0,76 |
| Lithuania | 0,66 | 0,70 | 0,73 | 0,73 | 0,75 | 0,81 | 0,75 | 0,84 | 0,87 | 0,82 | 0,87 |
| Qatar | 0,64 | 0,64 | 0,64 | 0,62 | 0,65 | 0,70 | 0,71 | 0,71 | 0,72 | 0,71 | 0,73 |
| Portugal | 0,72 | 0,70 | 0,69 | 0,71 | 0,72 | 0,78 | 0,80 | 0,81 | 0,83 | 0,80 | 0,82 |
| Slovakia | 0,63 | 0,62 | 0,61 | 0,66 | 0,64 | 0,71 | 0,72 | 0,76 | 0,78 | 0,77 | 0,79 |
| Latvia | 0,73 | 0,73 | 0,72 | 0,71 | 0,71 | 0,71 | 0,70 | 0,75 | 0,78 | 0,77 | 0,78 |
| Poland | 0,64 | 0,65 | 0,65 | 0,65 | 0,67 | 0,75 | 0,79 | 0,84 | 0,85 | 0,84 | 0,85 |
| Saudi Arabia | 0,67 | 0,68 | 0,69 | 0,70 | 0,69 | 0,71 | 0,71 | 0,78 | 0,80 | 0,78 | 0,79 |
| China | 0,54 | 0,54 | 0,55 | 0,57 | 0,60 | 0,64 | 0,68 | 0,78 | 0,79 | 0,78 | 0,79 |
| Bahrain | 0,69 | 0,74 | 0,81 | 0,75 | 0,79 | 0,78 | 0,81 | 0,82 | 0,82 | 0,81 | 0,81 |
| Italy | 0,72 | 0,74 | 0,76 | 0,77 | 0,77 | 0,81 | 0,82 | 0,82 | 0,82 | 0,82 | 0,83 |
| Hungary | 0,72 | 0,70 | 0,66 | 0,68 | 0,69 | 0,70 | 0,73 | 0,75 | 0,77 | 0,77 | 0,77 |
| Croatia | 0,73 | 0,69 | 0,63 | 0,63 | 0,66 | 0,70 | 0,70 | 0,75 | 0,77 | 0,76 | 0,78 |
| Greece | 0,69 | 0,70 | 0,71 | 0,70 | 0,73 | 0,75 | 0,78 | 0,79 | 0,80 | 0,80 | 0,77 |
| Bulgaria | 0,61 | 0,57 | 0,54 | 0,53 | 0,59 | 0,64 | 0,72 | 0,76 | 0,80 | 0,76 | 0,78 |
| Romania | 0,61 | 0,59 | 0,56 | 0,66 | 0,59 | 0,65 | 0,67 | 0,74 | 0,76 | 0,74 | 0,75 |
| Uruguay | 0,63 | 0,71 | 0,74 | 0,73 | 0,75 | 0,72 | 0,70 | 0,70 | 0,71 | 0,71 | 0,72 |
| Thailand | 0,51 | 0,50 | 0,46 | 0,63 | 0,61 | 0,63 | 0,65 | 0,72 | 0,76 | 0,73 | 0,74 |
| Turkey | 0,53 | 0,54 | 0,54 | 0,63 | 0,61 | 0,65 | 0,71 | 0,74 | 0,77 | 0,77 | 0,77 |
| Georgia | 0,56 | 0,59 | 0,60 | 0,64 | 0,68 | 0,68 | 0,69 | 0,71 | 0,72 | 0,70 | 0,70 |
| Costa Rica | 0,54 | 0,60 | 0,61 | 0,60 | 0,61 | 0,65 | 0,70 | 0,75 | 0,76 | 0,74 | 0,76 |
| South Africa | 0,49 | 0,48 | 0,49 | 0,50 | 0,50 | 0,58 | 0,66 | 0,68 | 0,69 | 0,69 | 0,71 |
| Serbia | 0,63 | 0,60 | 0,55 | 0,55 | 0,64 | 0,69 | 0,72 | 0,72 | 0,75 | 0,74 | 0,74 |
| Kazakhstan | 0,68 | 0,70 | 0,73 | 0,71 | 0,73 | 0,74 | 0,76 | 0,83 | 0,84 | 0,81 | 0,82 |
| Azerbaijan | 0,50 | 0,51 | 0,55 | 0,58 | 0,54 | 0,59 | 0,66 | 0,70 | 0,71 | 0,69 | 0,71 |
| Jordan | 0,49 | 0,50 | 0,52 | 0,52 | 0,55 | 0,55 | 0,56 | 0,52 | 0,53 | 0,53 | 0,53 |
| Argentina | 0,62 | 0,63 | 0,63 | 0,65 | 0,66 | 0,69 | 0,73 | 0,81 | 0,83 | 0,81 | 0,83 |
| Indonesia | 0,49 | 0,44 | 0,45 | 0,48 | 0,50 | 0,50 | 0,53 | 0,61 | 0,66 | 0,61 | 0,65 |
| Brazil | 0,62 | 0,61 | 0,60 | 0,60 | 0,63 | 0,69 | 0,73 | 0,75 | 0,77 | 0,76 | 0,77 |
| Mexico | 0,62 | 0,60 | 0,57 | 0,56 | 0,63 | 0,67 | 0,68 | 0,71 | 0,73 | 0,72 | 0,72 |
| Vietnam | 0,52 | 0,50 | 0,47 | 0,45 | 0,54 | 0,57 | 0,59 | 0,63 | 0,67 | 0,68 | 0,68 |
| Ukraine | 0,57 | 0,51 | 0,50 | 0,52 | 0,53 | 0,59 | 0,62 | 0,70 | 0,71 | 0,73 | 0,73 |
| India | 0,38 | 0,39 | 0,38 | 0,42 | 0,47 | 0,53 | 0,57 | 0,57 | 0,60 | 0,60 | 0,61 |
| Philippines | 0,51 | 0,50 | 0,48 | 0,52 | 0,53 | 0,60 | 0,65 | 0,67 | 0,69 | 0,69 | 0,71 |
| Rwanda | 0,33 | 0,34 | 0,36 | 0,37 | 0,40 | 0,43 | 0,46 | 0,47 | 0,48 | 0,48 | 0,51 |
| Kenya | 0,42 | 0,39 | 0,38 | 0,39 | 0,41 | 0,44 | 0,45 | 0,53 | 0,53 | 0,52 | 0,53 |
| Iran | 0,49 | 0,45 | 0,45 | 0,47 | 0,47 | 0,56 | 0,61 | 0,65 | 0,66 | 0,66 | 0,67 |
| Colombia | 0,66 | 0,64 | 0,62 | 0,62 | 0,63 | 0,65 | 0,69 | 0,70 | 0,72 | 0,71 | 0,72 |
| Namibia | 0,39 | 0,39 | 0,39 | 0,40 | 0,42 | 0,44 | 0,46 | 0,51 | 0,57 | 0,58 | 0,58 |
| Ecuador | 0,49 | 0,50 | 0,51 | 0,51 | 0,54 | 0,58 | 0,61 | 0,70 | 0,70 | 0,70 | 0,72 |
| Ghana | 0,32 | 0,37 | 0,37 | 0,39 | 0,40 | 0,47 | 0,54 | 0,59 | 0,60 | 0,60 | 0,60 |

| Country | The level of development of digital government | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 | 2022 |
| Sri Lanka | 0,44 | 0,52 | 0,54 | 0,55 | 0,54 | 0,56 | 0,58 | 0,66 | 0,67 | 0,66 | 0,68 |
| Tunisia | 0,48 | 0,53 | 0,54 | 0,56 | 0,56 | 0,62 | 0,63 | 0,64 | 0,65 | 0,64 | 0,62 |
| Peru | 0,52 | 0,54 | 0,54 | 0,53 | 0,61 | 0,63 | 0,65 | 0,69 | 0,71 | 0,69 | 0,70 |
| Morocco | 0,32 | 0,42 | 0,51 | 0,50 | 0,50 | 0,52 | 0,52 | 0,56 | 0,57 | 0,57 | 0,57 |
| Lebanon | 0,51 | 0,44 | 0,50 | 0,50 | 0,55 | 0,55 | 0,55 | 0,53 | 0,50 | 0,51 | 0,51 |
| Bosnia and Herzegovina | 0,53 | 0,48 | 0,47 | 0,48 | 0,52 | 0,52 | 0,53 | 0,60 | 0,64 | 0,63 | 0,63 |
| Egypt | 0,46 | 0,48 | 0,51 | 0,50 | 0,51 | 0,53 | 0,49 | 0,54 | 0,55 | 0,54 | 0,55 |
| Pakistan | 0,28 | 0,26 | 0,26 | 0,26 | 0,29 | 0,33 | 0,36 | 0,41 | 0,42 | 0,41 | 0,42 |
| Uganda | 0,32 | 0,30 | 0,26 | 0,28 | 0,32 | 0,38 | 0,41 | 0,43 | 0,45 | 0,46 | 0,45 |
| Tanzania | 0,33 | 0,31 | 0,28 | 0,29 | 0,30 | 0,34 | 0,39 | 0,41 | 0,42 | 0,42 | 0,42 |
| Algeria | 0,36 | 0,33 | 0,31 | 0,35 | 0,36 | 0,41 | 0,42 | 0,51 | 0,52 | 0,50 | 0,52 |
| Ivory Coast | 0,26 | 0,23 | 0,20 | 0,23 | 0,25 | 0,27 | 0,28 | 0,44 | 0,45 | 0,44 | 0,45 |
| Bangladesh | 0,30 | 0,29 | 0,28 | 0,29 | 0,34 | 0,44 | 0,49 | 0,51 | 0,52 | 0,50 | 0,52 |
| Bolivia | 0,47 | 0,46 | 0,46 | 0,46 | 0,52 | 0,53 | 0,53 | 0,63 | 0,61 | 0,61 | 0,63 |
| Cambodia | 0,29 | 0,29 | 0,30 | 0,30 | 0,35 | 0,36 | 0,38 | 0,45 | 0,51 | 0,51 | 0,51 |
| Laos | 0,29 | 0,28 | 0,27 | 0,28 | 0,30 | 0,30 | 0,31 | 0,32 | 0,33 | 0,32 | 0,33 |
| Nigeria | 0,27 | 0,28 | 0,29 | 0,33 | 0,36 | 0,37 | 0,38 | 0,40 | 0,44 | 0,43 | 0,45 |
| Cameroon | 0,31 | 0,29 | 0,28 | 0,29 | 0,32 | 0,37 | 0,40 | 0,37 | 0,43 | 0,43 | 0,44 |
| Ethiopia | 0,23 | 0,24 | 0,26 | 0,27 | 0,31 | 0,32 | 0,35 | 0,31 | 0,27 | 0,26 | 0,26 |

Source: systematized by the author based on EU4Digital, IMF, MoneyControl

Thus, 4 clusters of countries were formed: leaders, promising, problematic and inhibiting.

Using cluster analysis, four clusters were formed. It is worth noting that the choice of a specific method of cluster analysis depends on the classification.

Using cluster analysis, countries were divided into four clusters.

Table 4. Clustering of countries by level of digitization and digital government (developed by the author)

| | | Name | Country |
|---|---|---|---|
| 8,45-15,44 | Cluster 4 | Problematic | Egypt, Pakistan, Uganda, Tanzania, Algeria, Ivory Coast, Bangladesh, Bolivia, Cambodia, Laos, Nigeria, Cameroon, Ethiopia; |
| 15,45-22,44 | Cluster 3 | Retarded | Bahrain, Hungary, Croatia, Greece, Bulgaria, Romania, Uruguay, Thailand, Turkey, Georgia, Costa Rica, South Africa, Serbia, Kazakhstan, Azerbaijan, Jordan, Argentina, Indonesia, Brazil, Mexico, Vietnam, Ukraine, India, Philippines, Rwanda, Kenya, Colombia, Ecuador, Ghana, Sri Lanka, Tunisia, Peru, Morocco, Lebanon, Bosnia and Herzegovina; |
| 22,45-29,44 | Cluster 2 | Promising | Estonia, Israel, UAE, Belgium, France, Spain, Slovenia, Czech, Malaysia, Lithuania, Qatar, Portugal, Slovakia, Latvia, Poland, Saudi Arabia,China, Italy; |
| 29,45-36,44 | Cluster 1 | Leaders | Singapore, USA, Finland, Denmark, Norway, Switzerland, Netherlands, Sweden, Iceland, Ireland, South Korea, Australia, Canada, New Zealand, Germany, Austria, Japan. |

Source: Author's calculated

Thus, as can be seen from the results of the clustering of the country, white is divided into: leaders, promising, slowing down and problematic.

In order to achieve the research topic, the author proposes to reveal these clusters. "Leaders" cluster. This zone includes economies that are characterized by a high initial level of digitization and a strong pace of development in this area. Three countries stand out here: Singapore, Finland, Switzerland. Along with several other economies — for example, Denmark, Norway, the Netherlands — they consistently rank among the leaders in such indices, demonstrating both adaptability and institutional support for innovation. Interestingly, the US ranks fourth in digital evolution after Singapore: an outstanding growth rate for an economy of its size and complexity. Each individual case of each country is unique, but the analysis suggests that the most successful of them chose the following priorities:

1. Support for the implementation of digital consumer tools (online shopping, digital payments, entertainment, etc.);
2. Recruitment, training and retention of IT personnel;
3. Fostering digital startups;
4. Provision of fast and publicly available access to the Internet — both terrestrial (for example, fiber optic) and mobile;
5. Specialization in the export of digital goods, services or media;
6. Coordinated innovation process: universities, businesses and ministries responsible for digital development.

"Promising" cluster. This zone is characterized by economies whose digital infrastructure is still limited, but which are rapidly developing. This is where France stands out: it is significantly ahead of all other countries in terms of the pace of digital evolution — primarily due to a combination of rapidly growing demand and innovation. Two more notable members of the group are Belgium and Israel: these are huge countries that occupy the third and fourth places in the world in terms of growth rates. In addition to these large developing countries, several medium-sized countries - such as Estonia, the UAE, Spain, Slovenia, the Czech Republic - are also experiencing accelerated digital development, which indicates the potential for the flourishing of digitalization, which will have a beneficial effect on the recovery of the economy after the COVID-19 pandemic, and for long-term transformation.

Based on our analysis, the author found that successful breakthrough economies focus on the following tasks:

1. Improvement of mobile Internet access, its availability and quality for wider dissemination of innovations;
2. Strengthening the institutional environment and development of digital legislation;
3. Encouraging investments in digital enterprises, financing digital R&D, training IT personnel and using applications to create jobs;
4. Actions to reduce inequalities in access to digital tools along gender, class, ethnic and geographic lines (although access remains largely uneven).

"Retarded" cluster. This zone includes countries with mature digital systems, but a low pace of further development. Many of these countries are members of the European Union. This is partly due to the natural growth slowdown that comes with maturity. In addition, many countries in the zone have deliberately decided to sacrifice growth rates for responsible and inclusive development. In order to return to growth rates (at the same time without giving up their values), these countries should make the following tasks a priority:

1. Protection against "digital plateaus": further investment in stable institutional pillars, regulatory environment and capital markets to support further innovation;
2. Continued use of policy tools and regulation to ensure equal access to digital opportunities and protect all consumers from privacy breaches, cyber-attacks and other threats (while preserving data availability for new digital applications);

3. Attracting, training and retaining professionals with digital skills — most often through immigration policy reforms;
4. Identification of new technological niches and creation of ecosystems that promote innovation in these areas.

"Problematic" cluster. After all, the last zone, which includes countries from Africa, Asia, North America and Southern Europe, is characterized by both problems in the existing digital ecosystem and a low growth rate. The countries of this zone should take an example from promising economies in using digital growth as a tool for economic stability. In particular, in those troubled economies where there is good demand in the digital segment, the priorities should be as follows:

1. Long-term investments in solving basic infrastructure problems;
2. Creating an institutional environment that supports the safe and widespread distribution of digital products and services among consumers — especially if these products contribute to productivity and the creation of new jobs;
3. Support of initiatives for the development of digital access for segments of the population that are historically in a weak position (especially due to the cooperation of the state with private business);
4. Support programs that solve pressing problems and thus can become catalysts for the spread of digital tools (for example, digital payment platforms).

The development of a basic system of indicators for monitoring the digitalization of the economy and social relations is being conducted by many influential international organizations, institutions and various analytical agencies. The most common methods of assessing the state of development of the digital economy are the formation of rating indexes.

Using the analysis of indices, the author singled out those that, in his opinion, are the most appropriate from the point of view of determining the level of development of digital trade in global markets (Table 5).

Table 5. Indices of the level of development of digital trade in global markets (highlighted by the author)

| Name of the index | Definition | Characteristic |
|---|---|---|
| *Development of digital trade markets* | | |
| Digital Evolution Index | DEI | The Digital Evolution Index (DEI) is the basis of the rating of the country's digital development and competitiveness, formed by Taft University (USA) together with Mastercard. The rating takes into account two main factors: the current level of digital development and the growth rate of digitization over the past nine years, which are determined on the basis of 170 indicators characterizing the rate of digitization. These indicators are combined into four sub-indices (level of supply, demand for digital technologies, institutional environment, innovation climate) and reflect progress in the digital transformation of the economy. Depending on the results of the DEI index calculation, all countries are divided into four categories: leaders, promising, slowing and problematic. |
| IMD World Digital Competitiveness Index | WDCI | The Global Digital Competitiveness Index (WDCI) of the Swiss business school IMD reflects the potential opportunities and readiness of various countries to adapt to the digital transformation of the economy. The WDCI index is based on 50 criteria, which are aggregated into three sub-indices of the first level, consisting of three sub-indices of the second level. The IMD Global Digital Competitiveness Score is calculated for the 63 countries covered by the WCY. Countries are ranked from most competitive to least digital. These ratings provide a more detailed analysis of specific aspects of digital transformation and can be used to assess a country's technological structure or support international investment decisions. |

| | | |
|---|---|---|
| *Development of information and communication technologies* | | |
| ICT Development Index | IDI | Calculated by the International Telecommunication Union (ITU) since 2009. In 2018, the index was supplemented with three new indicators such as: subscriptions to mobile broadband Internet traffic, the percentage of mobile phone owners and the percentage of people with ICT skills.<br>The IDI index is intended for:<br>monitoring of IT development in countries and their positioning on the global IT market;<br>measuring progress in ICT development in both developed and developing countries;<br>definition of the digital divide (differences between countries in terms of the level of ICT development);<br>identifying the potential of ICT development and the level to which countries can use it to enhance their own growth and development.<br>This index includes 28 indicators, which are calculated as a weighted average sum of three sub-indices: infrastructure development, online spending and user activity. All sub-indices are formed from the weighted average values of several parameters underlying them. |
| Networked Readiness Index | NRI | The NRI index is an assessment of a country's ability to use the capabilities of information and communication technologies for networking purposes. This index provides information on the main factors affecting the development of the network economy, with the aim of accounting for them in state policy. Such information in the long term contributes to the involvement of a larger number of people, organizations and communities from around the world in the network space. NRI not only assesses the readiness of a particular country to participate in the information world, but also shows what underlies the differences between countries. |
| *The degree of penetration of digital technologies into the economy and social life* | | |
| Boston Consulting Group | e-Intensity | The Boston Consulting Group created the BCG e-Intensity Index. It examines Internet activity for the members of the Organisation for Economic Co-operation and Development (OECD), for the BRICI nations of Brazil, India, China, and Indonesia, and for other noteworthy economies, such as Hong Kong, Saudi Arabia, Singapore, and South Africa. |
| Global Innovation Index | GII | The Global Innovation Index is an annual ranking of countries by their capacity for, and success in, innovation, published by the World Intellectual Property Organization. It is based on both subjective and objective data derived from several sources, including the International Telecommunication Union, the World Bank and the World Economic Forum.<br>The index is computed by taking a simple average of the scores in two sub-indices, the Innovation Input Index and Innovation Output Index, which are composed of five and two pillars respectively. Each of these pillars describe an attribute of innovation, and comprise up to five indicators, and their score is calculated by the weighted average method. |
| Digital Adoption Index | DAI | The DAI is a worldwide index that measures countries' digital adoption across three dimensions of the economy: people, government, and business. The index covers 180 countries on a 0–1 scale, and emphasizes the "supply-side" of digital adoption to maximize coverage and simplify theoretical linkages. The overall DAI is the simple average of three sub-indexes. Each sub-index comprises technologies necessary for the respective agent to promote development in the digital era: increasing productivity and accelerating broad-based growth for business, expanding opportunities and improving welfare for people, and increasing the efficiency and accountability of service delivery for government. DAI can assist policymakers in designing a digital strategy with tailored policies to promote digital adoption across different user groups. |
| Digital Economy and Society Index | DESI | This index gives an idea of the state of digitization of EU countries.<br>The DESI index consists of five sub-indices: connectivity, human capital, use of the Internet by the population, integration of business with digital technologies, digital public services The databases of the DESI index are those of Eurostat, ITU and the UN.<br>The DESI index is calculated as a composite index that summarizes various indicators of digital development and tracks the evolution of EU countries in terms of their digital competitiveness. The advantage of this index is that it includes the level of integration of digital technologies with business and the state, which gives a certain idea about the state of digital transformation of the economy. |

Source: Author's calculated

The author analyzed and systematized a large list of international indices, distinguishing three main blocks: the first block includes indices characterizing the level of development of e-commerce markets; in the second - indices evaluating the development of information and communication technologies; in the third - indices assessing the degree of penetration of digital technologies into the economy and social life.

Existing studies, which tend to conduct comparative analysis in terms of international differences, pay relatively less attention to the influencing factors of digital trade, especially lacking analysis of the influencing factors constructed using econometric models.

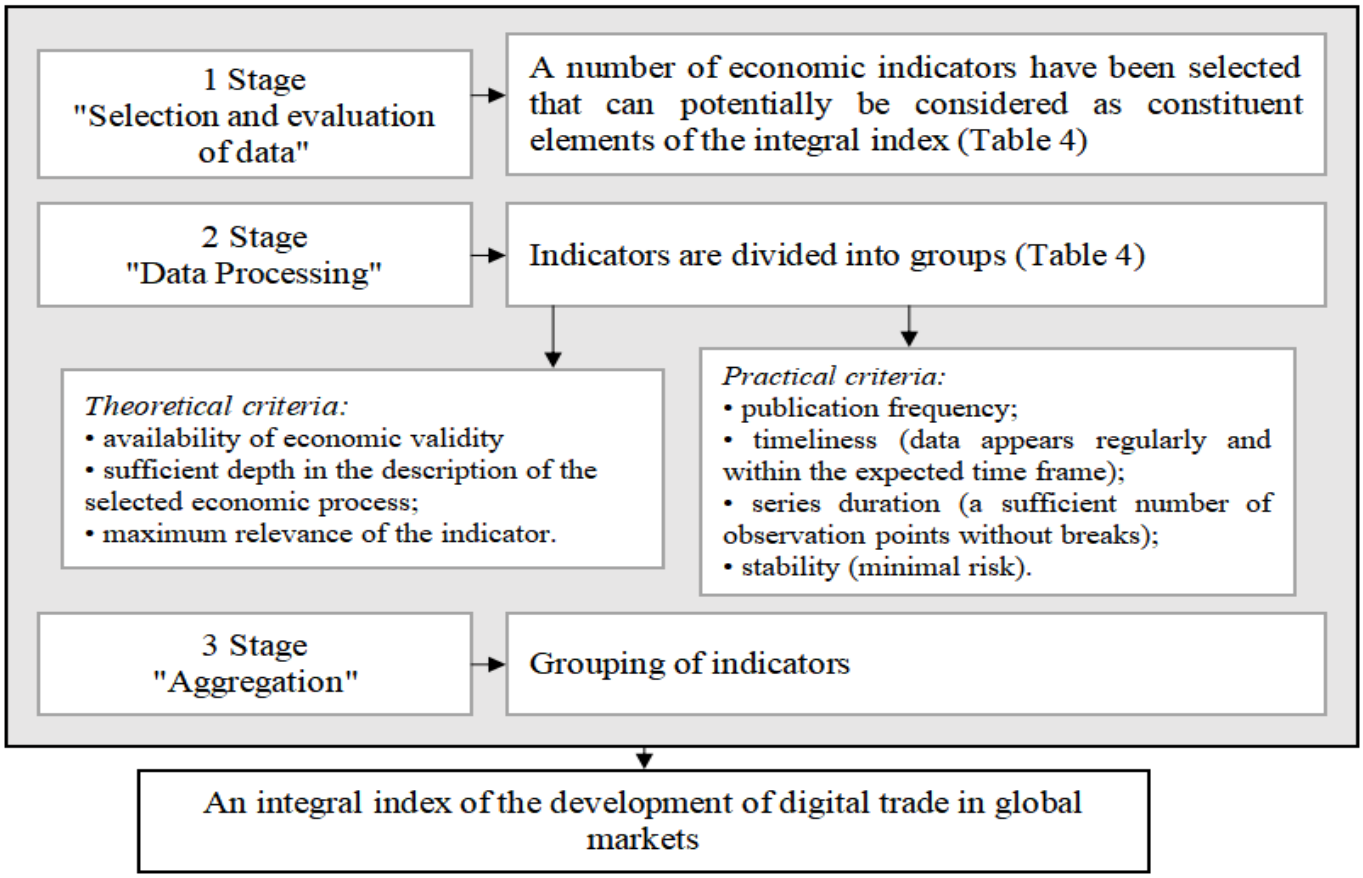
It is very important to note that this study aims to identify the commonalities between the differences and to identify the critical factors affecting digital trade by comparing the differences in digital trade between countries, based on which an analysis of how to optimize the organization and management at the national and corporate levels, with the aim of promoting digital trade for countries that are temporarily lagging behind, bridging the digital divide at the level of digital trade and giving a better role to digital trade promotion. in the economy.

At the same time, digital trade research can also enable many SMEs to participate in the international market through digital technologies, supporting them to perform better in a trade structure that exhibits increasing volatility and uncertainty.

The desire to combine multiple time series into one integral indicator for further use in assessing and forecasting the development of digital trade in global markets is appropriate in the author's opinion. Business cycles vary in length and depth. The influence of individual factors is also unstable. That is why the integrated indicator, in the opinion of the author, better describes the general economic dynamics of the development of digital trade on global markets.

The author made an attempt to construct an integral index to determine the development of digital trade on global markets.

Figure 1. Algorithm for building an integral index of the development of digital trade in global markets (author's vision)




Source: Author's calculated

The Composite Index of Cyclical Indicators is a composite indicator designed to determine the development of digital trade in global markets.

The process of building an integral index is shown in Fig. 1.

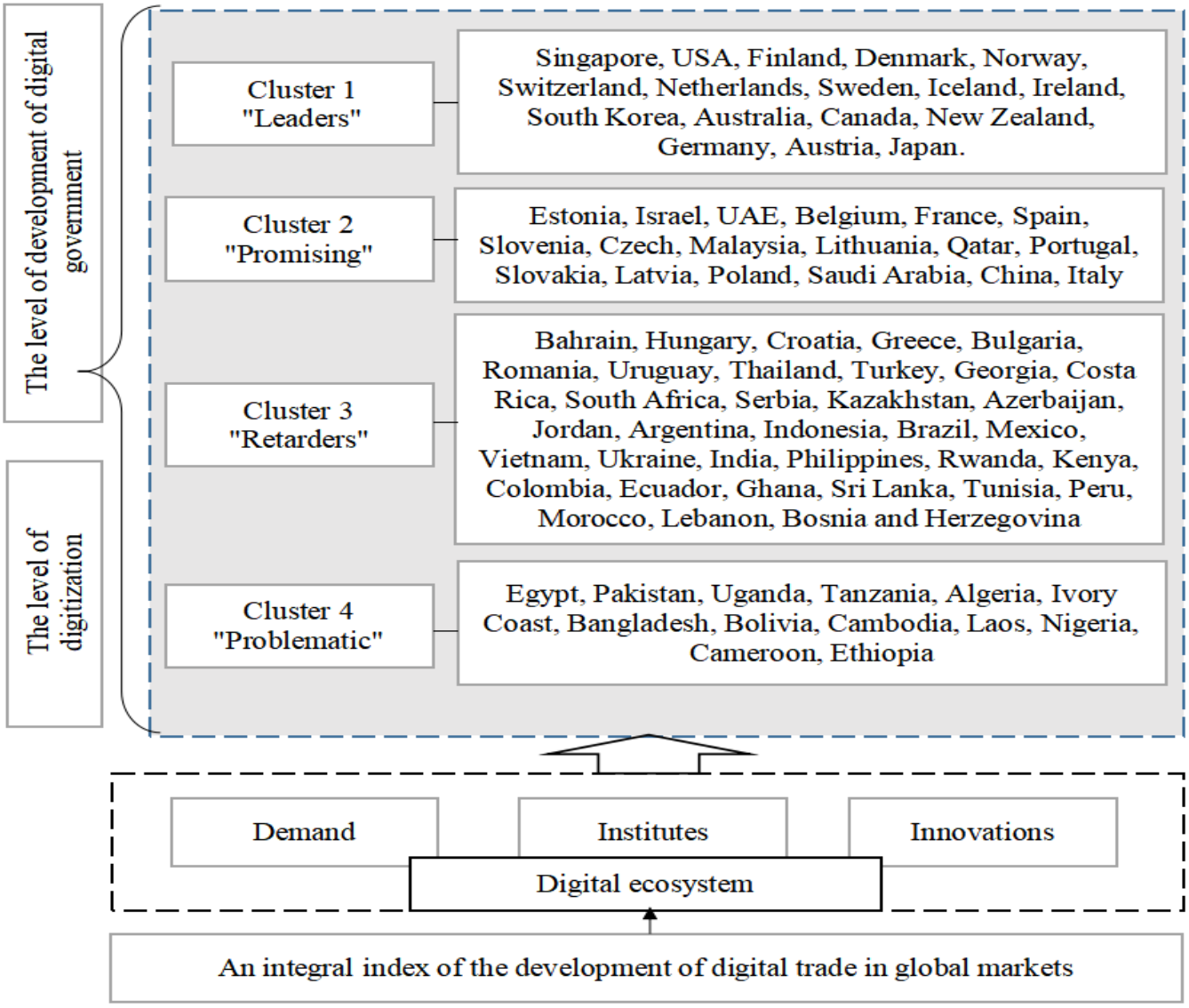
As can be seen from Fig. 1. the construction of the integral index is based on three stages. At the first stage, as part of data selection and evaluation, the author selected a number of economic indicators that can potentially be considered as constituent elements of one of the target integral indexes. (Table 4)

Then all the indicators were conditionally divided between several groups. (Table 4) This classification made it possible to provide the necessary breadth of data and guarantee a balanced representation of different indicators. At the same time, the selection and evaluation of indicators was carried out on the basis of theoretical and practical criteria.

At the last stage, the selected indicators are grouped based on a special aggregation methodology into an integral index of the development of digital trade on global markets.

Thus, the proposed integrated index allows you to accurately describe the development of digital trade in global markets and can be used for the purpose of forecasting the development of digital trade in global markets.

Figure 2. Methodological approach to determining the level of development of digital trade (author's vision)




Source: Author's calculated

As can be seen from Fig. 2. the methodological approach is built by clustering countries according to the level of digitization and the level of development of the digital society. The proposed approach

includes a digital ecosystem based on three components: demand, institutions and innovation. Also, it is worth noting that the methodological approach consists in the application of an integral index of the development of digital trade in global markets. The existing connection between the level of digitization of the country and the development of e-commerce is confirmed by the establishment of digital trade channels. Countries will be able to reach a qualitatively new level of trade, attract small and medium-sized businesses to it, and correct structural and sectoral imbalances through the development of digitalization. The transition of trade relations to the electronic sphere is currently facilitated by digitization and globalization conditions.

It is worth noting that the methodological approach makes it possible to assess the development of digital technologies at different levels of their use, as well as to assess the degree of digitization in the state, region, city and business.

Digital innovations and new business models are the engine of transformation for both the state and business.

Data-driven innovation, new business models and digital applications are changing what happens in science, governments and cities. Policy measures to support digital innovation focus on innovation networks, access to finance and the use of data, but pay less attention to investment in ICT, knowledge-based capital and data analysis. The impact of digital transformation is also manifested in the elimination and creation of jobs in various sectors, the emergence of new forms of work and changes in the landscape of trade, in particular services. In response, the government is revising labor laws and trade agreements.

Against the background of increasing intensity of use of ICT, enterprises and people are faced with increasing risk in the field of digital security and protection of personal information.

The potential of artificial intelligence is promising and, at the same time, raises serious political and ethical questions

Artificial intelligence opens up new horizons for increased efficiency and productivity, but at the same time it can exacerbate existing policy challenges and raise new political and ethical questions, for example about its potential impact on the future of work and skills development, or about the related implications for supervision and transparency, accountability, and security.

## 6.DISCUSSION

The basis of the methodological approach to determining the level of development of digital trade in global markets, according to the author, is the integral index of the development of digital trade in global markets. The difficulty of conducting a comparative assessment of the development of digital trade in global markets is due to the incommensurability of their economies and the presence of multidimensional, sometimes heterogeneous statistical data. The prospect for solving this problem opens up the development of an integral index that combines various sub-indices and indicators. This integral index included a list of key indicators responsible for digitization, digital access, digital economy, and others. It is worth noting that the included indicators are responsible for the level of development of digital trade markets, the development of technologies and the penetration of digitalization into social and economic life are evaluated. The developed index makes it possible to rank countries according to the general index. The values of individual indicators of the sub-indices make it possible to determine to what extent the existing potential for the development of digital trade in global markets is used. In addition, the use of the proposed toolkit allows you to monitor the change in country indices over time, provided that the normalized values of the indicators used are preserved.

However, in order to build a methodological approach, it was important to make the ratio of the selected sub-indices to the integral indicator with the level of digitalization and the level of development of the digital government. The author chose these levels for the proposed approach, because the development of digital trade is ensured by digitization and support of government programs. Thus, this justifies the selection of the above-mentioned levels, which are the information basis for the clustering of countries included in the methodological approach.

## 7. CONCLUSIONS

The use of digital technologies and their introduction into social and economic life passed from the stage of formation to the next phase a long time ago. Digital commerce will eventually gain a complete monopoly, excluding some features of commerce. That is why the development of digital trade in global markets is the most urgent issue today, taking into account sustainable development.

The study is devoted to the development of a methodical approach to determining the level of development of digital trade in global markets by constructing an integral indicator and clustering countries according to the level of digitalization and development of digital government.

The article uses the method of building an integral index with the procedure of normalizing the values of indicators to ensure their compatibility. Weighting coefficients of indicators were determined by the method of expert evaluations.

The results of the research can be applied in the analytical support of the policy regarding the improvement of the conditions for the development of digital trade in global markets and the creation in the future of a single space of digital trade, which contributes to the strengthening of global economic integration and ensures sustainable development. In addition, the article contains methodological recommendations that can be used to develop similar assessment tools for other groups of countries. The limitations of the study are related to the need to account for regional specific features of the analyzed countries or regions.

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